Faculty Working Papers

CONTRIBUTIONS OF QUARTERLY TIME SERIES COMPONENTS ANALYSIS TO CORPORATE FINANCE THEORY AND PLANNING

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#675

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Nourse, E. and H. Drury (1938), Industrial Price Policies and Economic Progress, Washington, D.C.

Porter, Michael (1974), "Consumer Behavior, Retail Power, and Market Performance in Consumer Goods Industries," The Review of Economics and Statistics, 56 (November), 419-36.

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USING THE DYNAMIC LIFE INSURANCE PROGRAMMING MODEL

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May 23, 1980

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Summary

This paper develops a model which can be used to help life insurance consumers decide how much insurance to purchase. The original dynamic programming model developed by Belth is updated and revised to obtain results relevant in today's environment. Sample results of the model are provided and sensitivity analysis is performed with respect to four key variables.

Using the Dynamic Life Insurance Programming Model

A question frequently addressed to insurance educators by students is "How much life insurance should I buy?" Many students, as well as members of the public at large, are understandably wary of relying on life insurance agents for the answer. This paper discusses a model that has been used with students at the University of Illinois in an attempt to devise a meaningful, objective approach to answering this important question.

Prior Research

Static life insurance programming has been widely used in various forms for many years. The static programming model usually assumes immediate death of the family breadwinner. The difference between projected income needs and resources is calculated in terms of current dollars, with the implication being that any gaps should be filled with insurance, subject to the family's ability to pay the premiums.[1] There are two main problems associated with the static model. First, the result is immediately outdated, necessitating frequent updates as family situations change. Second, inflation is ignored. In the inflationary environment which has existed in recent years and which may likely persist indefinitely, such an omission almost fatally flaws the static model.[2]

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[1] For a detailed account of the static programming process, see Robert I. Mehr, Life Insurance: Theory and Practice, rev. ed. (Dallas: Business Publications, Inc., 1977), 441-462.

[2] There are, however, some hidden safeguards within the static model. For example, although income needs will likely increase with inflation, social security benefits will also increase and will provide a partial offset to the increased needs.

A major shift away from this static approach was proposed by Belth[3] over fifteen years ago. Under Belth's dynamic programming model, the programmer specifies a set of family characteristics and income goals. Some of these values are held constant, although many are allowed to change over time. For example, provisions are made for inflation and for salary increases each year. The model specifies the value of income needs and resources available at death assuming death in year n, where n goes from the present time until the year in which the breadwinner is assumed to retire. Thus, given the assumption, the programmer can compare the needs and resources if death were to occur at any time during his or her projected working life. Presumably, insurance might be purchased to offset most or all of the gaps which are projected. Belth's model also calculates the income needs and resources available, should the programmer live to retirement.

The Belth model was a dramatic step forward when it was introduced. But the many sociological and economic changes which have occurred in the last fifteen years make the model much less appropriate for use now. Some of the shortcomings of Belth's model in the current environment are the following: (1) The model does not utilize life contingency factors. For example, in valuing a widow's income needs after the children are grown, Belth merely assumes that the woman will live to age 85. Thus, only rarely will the income need be properly valued. (2) No provision is made for two working spouses. (3) For the working spouse in the Belth model, earnings increase by a fixed dollar increment

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[3]Joseph M. Belth, "Dynamic Life Insurance Programming," Journal of Risk and Insurance 31 (December 1964): 539-556.

each year. An annual percentage increase in salary seems more appropriate. (4) No provision is made for employer-provided pension plans as a source of income during retirement. With the tremendous growth in benefit plans in general, allowance should be made for the possibility of pension benefits. (5) Also related to retirement, Belth requires the programmer to specify, as an input, the dollar value of the total annual retirement income need. A better method would have the programmer merely specify a desired relationship between retirement income and earnings immediately preceding retirment. (6) Finally, the effects of inflation can be incorporated much more thoroughly than is the case in the original Belth model. As an example, since the model was published, increases in social security benefits have been linked directly with increases in the Consumer Price Index. There are numerous other effects of inflation that should be considered, as will be pointed out later in this paper.

Belth's dynamic programming model has had very little popular acceptance to date. As indicated, many of the specific parts of the model need to be revised to make the results relevant today. However, the basic concept behind Belth's approach remains valid. This paper describes a dynamic model which approaches the programming problem in the same manner as does the Belth model. However, extensive changes have been made in order to obtain results which are useful in today's environment. This updated and revised version of the dynamic programming model has been tested by advanced insurance students at the University of Illinois, where it has been received with moderate enthusiasm. In addition to providing potentially useful information to prospective life

insurance buyers, the model is an effective educational tool which allows the student to become actively involved in the learning process.

The Model

The model described in this paper allows the programmer considerable flexibility in specifying the original inputs. In general, information must be provided concerning family status, employment details for either or both spouses, and existing insurance and savings. The programmer must also specify details concerning post-death and retirement income goals.

General Inputs to the Program

The program assumes the existence of a basic family unit consisting of a husband, a wife, and from one to ten children. The spouses can be any age up to and including age 99. The children can be any ages (up to 99), subject to the restriction that the youngest child must reach an independent financial status before both parents retire. One parent can be retired before the child achieves independence, but not both. In terms of the traditional terminology, the "family dependency period" must end before the last parent retires.

At least one spouse must have earned income, although both can work if desired. Each working spouse's earnings are assumed to increase each year (until retirement) by an inflation rate I and a productivity (or promotion) increase percentage. Negative productivity percentages can be specified to indicate that a spouse's earnings are not expected to keep pace with inflation. A productivity increase percent must also be specified for the general population, to be used in calculating future social security benefits. At

retirement, each spouse is assumed to receive an intial pension benefit equal to some percent of final year earnings. In subsequent years, the pension is assumed to increase each year by one half the inflation rate. (Of course, if the programmer does not want to consider pension benefits, the pension percent can be specified to be zero.)

From one to five insurance policies are assumed to exist for the husband; from one to five also exist on the wife's life. For any cash value policies, the programmer must specifiy the cash value of the policy at the insured's retirement age. If the programmer does not want one or both spouses to have existing insurance, the face amounts and cash values can be specified to be zero.

The initial amount of savings specified will increase each year by interest earnings and by additional deposits made from earned income. Concerning interest income, it is assumed that amounts up to some basic level are invested in "safe" assets, which earn interest at a fairly low rate K. Any savings in excess of this basic level, are invested in riskier assets which earn a higher rate of return. Each year the dividing line or "risky asset dividing line," is increased for inflation. The dividing line concept is also applied to the annual increment to savings made from current earned income, as is done in the original Belth model. The programmer sets an initial level LS. If combined spousal earnings are less than or equal to LS, it is assumed the couple will save a fairly low percent A of earnings. But when combined earnings exceed LS, the couple doesn't need as much for current consumption; thus, they can save a greater percent B of these "excess" earnings. The increment in this latter case is A(LS) + B(combined earnings - LS). The LS level is increased each year for inflation.

Premature-Death Needs

In general, all income needs specified by the programmer are in current dollar terms. For death-related calculations which are associated with an assumed death several years in the future, the needs are adjusted for price level changes, as described below for specific categories of needs associated with premature death.[4]

The programmer inputs current estimates of funeral and burial costs and a value for the amount of an emergency fund desired. In subsequent years, these estimates are increased by the inflation rate I. In any year in which death of a spouse occurs, the final expense need equals the sum of funeral and burial costs plus estate settlement expenses. Settlement costs are assumed to be equal to a percent Y times the total savings and insurance proceeds at that time. The only available offset considered in calculating the final expense gap is the $255 social security payment if the deceased had been employed. There are no offsets for the emergency fund.

The income needed for the first year of the family dependency period following the death of a spouse is calculated using the dividing line concept. This "line" is a basic family income survival level LI, the value of which is provided by the programmer. The total family income need equals LI + D(combined spouse earnings immediately preceeding death - LI), where D is a percentage figure also specified by the programmer. This income need is assumed to increase by the inflation rate each year during which there is at least one dependent child.

[4] Premature death is defined to be death before retirement.

Offsetting the income need are two potential resources: the earnings (if any) of the surviving spouse and the social security payments based on the earnings (if any) of the deceased spouse. Suitable adjustments in the social security benefit are made to account for social security family maximums and for possible reductions due to earnings of the surviving spouse. Each year of the family period the initial social security benefit increases with inflation, and the surviving spouse's earnings are increased for inflation and his/her productivity increase percent. The gap for the family period equals the present value of the income needs each year minus the present values of the offsets (earnings and social security), where all discounting is done at the "safe" interest rate K. Notably, life contingencies are not considered here. Rather, the assumption is made that the need will exist for as long as the family dependency period is expected to last. This assumption biases the results in two partially offsetting ways. Because the deaths of certain family members are not considered, the total income need is biased upwards, which biases the gap upwards. But the gap is also affected by a downward bias, if the surviving spouse has earned income. If the surviving working spouse were to die, an offset to the income need would be lost. The net effect of these offsetting factors will vary, depending on the situation.

The programmer must input a basic level of income LSP, in current dollars, which is desired for a surviving spouse after the family period ends, along with a percent F to be used in the usual way with the dividing line LSP. The surviving spouse's initial income need is

{LSP + F (combined earnings before death - LSP)}{1 + 1}^{x}, where x = number of years the family period lasted after death of the spouse. As with the other dividing lines, LSP is increased each year for inflation. Once the initial income need is calculated, it is assumed to increase each year by the inflation rate. Offsets for this income need include 1) surving spouse's earnings until retirement, 2) surviving spouse's pension after retirement, 3) social security, and 4) cash values of insurance policies on the life of the surviving spouse if he/she lives to retirement. Earnings before retirement increase each year as previously described. After retirement, the pension increases each year by I/2. The social security payment is the greater of the amount the survivor is entitled to as either 1) a retired worker or 2) a widow/widower. The payment increases each year with inflation. The gap with respect to the surviving spouse's need is the present value of the income needs each year minus the present values of all the offsets. All discounting is done taking into account both interest and mortality. The interest rate is K, as discussed previously. The mortality table used is the 1971 Individual Annuity Mortality Table (with males and females tabulated separately).

As in the Belth model, the program is run repeatedly, to show the gaps between needs and resources which would exist if either spouse were to die in any year between the current time and the time when both will be retired. It is left to the programmer to decide how to use these comparisons in making life insurance purchasing decisions. Frequently, the purchase of insurance equal to the maximum total gap will be prohibitively expensive. Needs must then be

ranked according to an individual's own priority scheme, and tradeoffs among those needs will be required.

Retirement Needs

The program indicates the gap between the present value of income needed if both spouses live to retirement, and the present value of resources available. The income need for the initial retirement year is calculated using a basic level LR (input in current dollars and increased for inflation to the time of retirement) and a percent G. The retirement need for the first year is LR + G (combined earnings before retirement - LR). This income need increases each year for inflation. Offsets to this need include cash values of life insurance policies, the pensions of both spouses (which increases each year by half the inflation rate), and the old-age social security payments to both spouses (which increase each year by the inflation rate). Concerning social security, provision is made for the fact that the benefit of one spouse may be entitled to as the wife/husband of a retired worker may exceed what she/he would get based on her/his own earnings. In this case, the social security payment to that spouse will double when the other spouse dies. With respect to cash values, if one spouse retires before the other, the cash values are assumed to increase at interest rate K until both are retired. The gap between retirement income needs and resources is the present value of the needs each year minus the present value of the offsets, considering both interest and mortality. The usual life contingency applications are applied. One item to be noted is that the income need each year is discounted back to the time of retirement using the probability that

at least one of the spouses remains alive. Thus, the need is not assumed to decrease with the death of one of the spouses.

Example and Sensitivity Analysis

Tables, 1, 2, and 3 show a sampling of the results obtained for a hypothetical family situation. The basic assumptions used as inputs for this example are the following:

<u>Husband</u>

Current Age = 35
Retirement Age = 65
Current Annual Earnings = $20,000
Productivity Increase Percent = -.03
Retirement Pension Percent = .70
Face Amounts of Existing Insurance = $10,000, $5000
Cash Values at Retirement = $8000, $3300

<u>Wife</u>

Current Age = 34
Retirement Age = 62
Current Annual Earnings = $10,000
Productivity Increase Percent = -.03
Retirement Pension Percent = .70
Face Amounts of Existing Insurance = $1000, $1000, $3000
Cash Values at Retirement = $200, $100, $500

<u>Children</u>

Number of Children = 2
Children's Ages = 11, 9
Family Dependency Period Ends When Youngest Child is Age = 18

<u>General</u>

Beginning Savings = $5000
Inflation Rate = .07
General Population Productivity Increase Percent = -.03

Basic Goals

Funeral and Burial Costs = $5000
Desired Emergency Fund = $3000
Risky Asset Dividing Line = $5000
Savings Increment Dividing Line = $15,000
Family Period Income Dividing Line = $22,000
Spousal Income Dividing Line = $18,000
Retirement Income Dividing Line = $23,000

Miscellaneous Percentages

Percent of Estate Used to Calculate Estate Settlement Costs = .05
Risk-Free Rate of Return = .05
Risky Rate of Return = .10
Percent Saved from Lower Bracket Income = .04
Percent Saved from Upper Bracket Income = .10
Percent Used to Set Family Period Needs = .70
Percent Used to Set Surviving Spouse's Needs = .70
Percent Used to Set Retirement Needs = .60

Although the program requires numerous inputs, all of the needs are stated in terms of current dollars; thus, the programmer can make judgments about needs based on existing conditions. In addition, many of the variables are readily observable, requiring little or no estimation. Some of the inputs which are somewhat difficult to estimate accurately are the inflation rate, the productivity increase percents, and the estate settlement percent. One of the most striking results evident in Tables 1, 2, and 3 is the magnitude of the gaps in many cases, particularly with respect to the needs of the surviving spouse. As will be evident in the subsequent sensitivity analysis, the large numbers result primarily because of the effects of the inflation rate over a long period. The protection ratios shown in Tables 1 and 2 provide a good summary of the situation of the survivors when one of the spouses dies. For example, if the husband were to die at age 40, his insurance plus the family's accumulated savings would make up

2.17 percent of the total income gap. For his death at age 64, even though inflation and an increased standard of living have pushed the total gap over $2.3 million, the savings have increased to a point such that the protection ratio exceeds 17 percent. The retirement ratio in Table 3 provides the same type of summary information for the situation in which both spouses live to retirement.

Insert Tables 1, 2, and 3 here

In order to assess the sensitivity of this model to particular inputs, the program was rerun for several variations of the preceding example. The effects of changing the husband's productivity increase percent, with all other inputs remaining the same as in the original example, are shown in Table 4. The husband's protection ratios generally decline somewhat as his productivity increases. The decline is due to the fact that projected needs are more closely linked to earnings before death than are the resources (savings and insurance) available to meet those needs. Thus, as the husband's salary increases at a faster rate, the needs at his death also increase more quickly. A much more dramatic effect is seen for the wife's protection ratios. When the wife dies and the husband is the surviving spouse, the protection ratios increase as the husband's productivity increases. The negative protection ratios indicate that the actual "gap" was negative, due to the husband's high projected earnings. As seen in Table 4, the negative ratios are more likely when the wife dies fairly early in life. If she lives almost to retirement, the income needs at her death are high, based on high

combined spousal earnings preceding her death. Futhermore, the husband has fewer working years remaining in which to use his earnings to offset the income needs; thus, for the very high productivity increases, the protection ratios tend to decline as the wife's death is delayed. As is expected, the retirement ratios tend to increase as the husband's productivity increases. Several factors are at work here. The basic retirement need increases as earnings prior to retirement increase. But social security payments, pension benefits, and savings also increase as earnings increase. The net effect in most cases is a higher retirement ratio associated with a higher productivity increase percent.

Insert Table 4 here

The sensitivity analysis associated with changing the assumed inflation rate is presented in Table 5. For the low rates, the results are as expected. That is, protection and retirement ratios decrease as inflation increases. Putting it another way, the family's resources are more sufficient to offset needs when prices are more nearly stable. However, what may appear to be a puzzling result is evident for the fairly high inflation rates. For example, when the husband dies in the first year, the protection ratio is higher with 13 percent inflation than it is with 11 percent inflation. Likewise, a similar phenomenon is evident for death in other years. In fact, for death of the husband anytime after 20 years, the survivor's financial situation improves as inflation worsens beyond 9 percent. The explanation for this seeming paradox lies in the fact that so many income resources in the program

are linked to the rate of inflation, plus the assumption of negative productivity increase percents for both the husband and wife. The negative productivity assumptions cause the spouses' earnings, and thus the initial income need calculated at the death of a spouse, to lag behind the inflation rate. But once death occurs, the offsets to the income need (in particular, social security) increase faster with a higher inflation rate. The effects of these inter-relationships show up through increased protection ratios. For death of a spouse in the early years, the effect is only evident at the highest inflation rates. But as the time of death approaches retirement age, when social security payments play such a large role, the effects are evident at lesser rates of inflation. These same general patterns also are apparent in both the wife's protection ratios and the retirement ratios.

Insert Table 5 here

The effects of varying the amount of income saved from earnings above the savings increment dividing line are shown in Table 6. All results are consistent with expectations. That is, the protection and retirement ratios increase as more of a family's earnings are set aside in savings. One interesting note concerns the retirement ratios. For the basic assumptions, a family which saved as much as 60 percent of its "excess" income would still only meet approximately half of the expected retirement needs.

Insert Table 6 here

The effects of changing the husband's pension level, shown in Table 7, show perhaps the least sensitivity to change of the four variables investigated. As expected, the level of the husband's pension has no effect on the protection ratios associated with death of the husband prior to his retirement. However, the protection ratios connected with the wife's death are affected somewhat by changes in the surviving husband's pension. As the pension increases, the protection ratios increase, with the increases being greater as the time of the wife's death approaches the time of expected retirement. Likewise, the retirement ratios increase as the pension percent increases. But even though the range of values investigated went from 10 to 90 percent of the husband's pre-retirement earnings, the retirement ratio only increased from 12.08 percent to 15.35 percent.

Insert Table 7 here

TABLE 1

Sample of Results Associated with Husband's Premature Death
(Using Basic Assumptions)

Year	Age	Final Expense Gap	Family Period Gap	Emergency Gap	Spouse Gap	Total Gap	Savings	Insurance	Protection Ratio
1	36	6213	65,857	3210	1,404,577	1,479,857	7350	15,000	.0151
2	37	6718	60,410	3435	1,438,867	1,509,430	9975	15,000	.0165
3	38	7265	54,278	3675	1,474,182	1,539,400	12,900	15,000	.0181
4	39	7857	47,410	3932	1,510,564	1,569,764	16,156	15,000	.0198
5	40	8496	39,754	4208	1,548,062	1,600,520	19,774	15,000	.0217
6	41	9188	31,250	4502	1,586,725	1,631,666	23,788	15,000	.0238
7	42	9936	21,837	4817	1,626,607	1,663,197	28,237	15,000	.0260
8	43	10,744	11,445	5155	1,667,765	1,695,109	33,162	15,000	.0284
9	44	11,618	0	5515	1,710,259	1,727,392	38,608	15,000	.0310
10	45	12,562	0	5901	1,725,664	1,744,127	44,624	15,000	.0342
15	50	18,557	0	8277	1,744,819	1,771,653	85,337	15,000	.0566
20	55	27,389	0	11,609	1,837,861	1,876,859	150,907	15,000	.0884
25	60	40,399	0	16,282	2,068,024	2,124,705	255,338	15,000	.1272
29	64	55,136	0	21,343	2,241,139	2,317,618	381,395	15,000	.1710

TABLE 2

Sample of Results Associated with Wife's Premature Death
(Using Basic Assumptions)

Year	Age	Final Expense Gap	Family Period Gap	Emergency Gap	Spouse Gap	Total Gap	Savings	Insurance	Protection Ratio
1	35	5713	24,477	3210	987,877	1,021,277	7350	5,000	.0121
2	36	6218	19,928	3435	1,000,813	1,030,394	9975	5,000	.0145
3	37	6765	15,671	3675	1,013,633	1,039,744	12,900	5,000	.0172
4	38	7357	11,765	3932	1,026,318	1,049,373	16,156	5,000	.0202
5	39	7996	8,275	4208	1,038,848	1,059,327	19,774	5,000	.0234
6	40	8688	5,271	4502	1,051,202	1,069,663	23,788	5,000	.0269
7	41	9436	2,832	4817	1,063,376	1,080,461	28,237	5,000	.0308
8	42	10,244	1,044	5155	1,075,393	1,091,836	33,162	5,000	.0350
9	43	11,118	0	5515	1,087,267	1,103,900	38,608	5,000	.0395
10	44	12,062	0	5901	1,087,941	1,105,905	44,624	5,000	.0449
15	49	18,057	0	8277	1,082,062	1,108,396	85,337	5,000	.0815
20	54	26,889	0	11,609	1,147,564	1,186,062	150,907	5,000	.1314
25	59	39,899	0	16,282	1,331,326	1,387,508	255,338	5,000	.1876
29	63	54,636	0	21,343	1,454,919	1,530,897	381,395	5,000	.2524

TABLE 3

Results Associated with Both Spouses Living to Retirement
(Using Basic Assumptions)

Resources	
Savings	$420,251
Cash Values (H)	11,300
Cash Values (W)	882
Total	$432,433

Total Retirement Gap
$3,007,091

Retirement Ratio
.1438

TABLE 4

Sample of Protection and Retirement Ratios
Obtained by Varying Husband's Productivity Increases

Husband's Protection Ratios:	Husband's Productivity Increases						
Year	-.05	-.03*	-.01	.00	.01	.03	.05
1	.0153	.0151	.0149	.0148	.0147	.0144	.0142
10	.0373	.0342	.0317	.0305	.0293	.0271	.0250
20	.0779	.0884	.0810	.0749	.0705	.0623	.0547
29	.1456	.1710	.1924	.1711	.1542	.1309	.1093
Wife's Protection Ratios:							
Year							
1	.0105	.0121	.0159	.0202	.0329	-.0405	-.0090
10	.0400	.0449	.0562	.0684	.1001	-.2863	-.0414
20	.0912	.1314	.1692	.1919	.2395	.8820	-.3318
29	.1793	.2524	.3967	.3923	.3897	.4357	.4676
Retirement Ratios:							
Year							
30	.1123	.1438	.2275	.2910	.2917	.2828	.3094

*The basic assumption.

TABLE 5

Sample of Protection and Retirement Ratios
Obtained by Varying the Inflation Rate

Husband's Protection Ratios:	Inflation Rate						
Year	.00	.03	.05	.07*	.09	.11	.13
1	.0804	.0435	.0266	.0151	.0086	.0058	.0076
10	.2030	.1022	.0607	.0342	.0216	.0171	.7097
20	.6253	.2717	.1507	.0884	.0606	.0669	-.0366
29	1.5351	.5659	.2921	.1710	.1183	.1542	-.0505
Wife's Protection Ratios:							
Year							
1	.0684	.0357	.0214	.0121	.0064	.0033	.0016
10	.2588	.1290	.0775	.0449	.0252	.0138	.0075
20	.8781	.3780	.2193	.1314	.0833	.0604	.0687
29	2.2213	.7969	.4170	.2524	.1871	.3515	-.0568
Retirement Ratios:							
Year							
30	1.7465	.5528	.2739	.1438	.0974	.1290	-.0367

*The basic assumption.

TABLE 6

Sample of Protection and Retirement Ratios
Obtained by Varying the Upper Bracket Savings Increment

	Upper Bracket Increment						
Husband's Protection Ratios:							
Year	.05	.10*	.20	.30	.40	.50	.60
1	.0146	.0151	.0161	.0171	.0181	.0192	.0202
10	.0272	.0342	.0481	.0620	.0759	.0898	.1036
20	.0661	.0884	.1328	.1770	.2211	.2649	.3085
29	.1277	.1710	.2571	.3425	.4271	.5110	.5942
Wife's Protection Ratios:							
Year							
1	.0114	.0121	.0136	.0150	.0165	.0180	.0194
10	.0339	.0449	.0668	.0887	.1105	.1323	.1541
20	.0962	.1314	.2015	.2711	.3401	.4087	.4768
29	.1870	.2524	.3819	.5098	.6360	.7605	.8835
Retirement Ratios:							
Year							
30	.1068	.1438	.2178	.2917	.3657	.4396	.5136

*The basic assumption.

TABLE 7

Sample of Protection and Retirement Ratios
Obtained by Varying Husband's Pension Percent

Husband's Protection Ratios:	Husband's Pension Percent						
Year	.10	.25	.50	.60	.70*	.80	.90
1	.0151	.0151	.0151	.0151	.0151	.0151	.0151
10	.0342	.0342	.0342	.0342	.0342	.0342	.0342
20	.0884	.0884	.0884	.0884	.0884	.0884	.0884
29	.1710	.1710	.1710	.1710	.1710	.1710	.1710
Wife's Protection Ratios:							
Year							
1	.0109	.0111	.0117	.0119	.0121	.0123	.0126
10	.0385	.0400	.0425	.0437	.0449	.0461	.0475
20	.1041	.1098	.1209	.1259	.1314	.1375	.1441
29	.1869	.1999	.2260	.2385	.2524	.2680	.2858
Retirement Ratios:							
Year							
30	.1208	.1258	.1352	.1394	.1438	.1485	.1535

*The basic assumption.

Faculty Working Papers

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